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On the genus *Dryopteris*

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The genus *Dryopteris* includes, as delimited in my Index Filicum, nearly one thousand species. Like most other genera of ferns, it has reached its greatest degree of development in the tropics; northward it extends to Greenland and Alaska, southward to New Zealand, and it is represented in almost all regions inhabited by ferns, the southernmost part of South America being a marked exception. It is scarcely to be expected that this vast number of species were all derived from the same ancestors, and I have thought it possible, by a detailed examination of a large number of species, to find out whether the species really are all congeneric or not. I believe I have succeeded in solving this question.

While older authors considered a single character, as, for instance, the shape of the sori, indusium, venation, as sufficient for distinguishing genera, we are nowadays inclined to see the best generic characters in the general habit and growth of the species, and it must be granted that by considering these characters the prime ones, we have reached a much more natural arrangement of the ferns than before. The systematic arrangement of Diels, in Engler and Prantl, *Natürliche Pflanzenfamilien*, followed in my Index Filicum, highly surpasses the sys-

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tem of the Synopsis Filicum of Hooker, but it is by no means equally natural in all points. Diels united into a single genus, *Nephrodium* (now *Dryopteris*), all the species previously referred to *Lastrea*, *Nephrodium*, *Phegopteris*, *Goniopteris*, *Leptogramma*, and *Meniscium*. It is difficult to give a diagnosis of a genus including such different forms; but characters common to all species are the inarticulated stipes, the round or somewhat oblong dorsal sori, which are often covered by reniform indusia, and the never complicated venation. It is true that there is a great uniformity as to these characters, and species showing them must naturally belong together, but the question now arises, whether all these species belong to a single genus or to several natural genera, which together form a tribe, the Dryopterideæ. Many attempts have been made to segregate groups of species as genera; about thirty genera have been described by different authors, but only some few of them have been at any time generally accepted, e. g., *Lastrea*, *Nephrodium*, and *Phegopteris*. *Phegopteris* is even now considered a distinct genus by North American pteridologists. All these genera were founded on single characters, viz., whether indusiate or not, with the veins free or anastomosing, the sori round or oblong; but it must soon become obvious to each student of these ferns that none of the characters mentioned indicates a real affinity between the species placed under the same genus. Considering the species of temperate regions only, *Dryopteris* and *Phegopteris* appear very different, and it has seemed very natural to place our species under two genera. It must, however, be remembered that our species are poor representatives of a group of plants that reaches its highest development within the tropics. It is quite unnatural to found genera on such outlying species alone, in which differential characters have become stable ones, while in the tropical forms these same characters are highly

variable. By examining a series of tropical Dryopterids, we soon find that such a character as the presence or absence of indusia is of no generic value, and even difficult to use as a specific character. A very large number of species, which have been referred to *Phegopteris*, are really indusiate, but the indusia are to be seen only in the very young sori. Moreover, we find very often that two forms, which can scarcely be distinguished by any other character, differ from each other only by the one being indusiate, the other exindusiate, but that, notwithstanding this difference, the two forms are closely related and must be referred to the same genus or even species. Quite the same can be said on the shape of the sori and on the venation, if goniopteroid (i. e., forming a few areolæ) or not. Genera founded on such characters (such as *Phegopteris*, etc.) are, therefore, not groups of related species, as natural genera should be, but may include a number of species that are often of a very remote affinity, e. g., *D. tetragona* and *D. phegopteris*, both sometimes referred to *Phegopteris*; on the other hand, species referred partly to one, partly to another genus, are intimately related, e. g., *D. patens*, often referred to *Lastrea*, and *D. mollis* (*D. parasitica*), which is a *Nephrodium*.

For these reasons I referred in my Index all these different species to a single genus, *Dryopteris*, although I was convinced that the genus ought to be divided into several genera. I could not accept the old genera, but I did not then know how I should divide *Dryopteris* in a natural manner. Since then I have examined thousands of specimens of American Dryopterids, belonging to about three hundred species, and I will try in a monograph, soon to be published, to arrange the species in quite a new manner. I do not intend now to create new genera, but I will divide the genus into provisional subgenera, several of which no doubt are good genera,

but *vestigia terrent*. These groups are not based on a single character, but the species belonging to the same subgenus agree in several respects. The characters used are often apparently very minute and have previously been seldom considered as of any value, but they are, nevertheless, very constant. The best and most constant character is the pubescence, i. e., the type of hairs and scales. I have never found that a species varies as to the kind of pubescence; further, species that agree in other characters correspond exactly in pubescence, not in the more or less dense covering by hairs and scales but in the shape of the hairs and scales. For example, all species belonging to the subgenus *Ctenitis* have always only short, multicellular, articulated hairs and very characteristic toothed scales; those belonging to *Goniopteris* have always stellate or forked hairs, etc.

Sorting the North American species of *Dryopteris* according to my new classification, we have the following subgenera represented north of Mexico:

1. EUDRYOPTERIS (*Dryopteris* proper). Here belong the following species: *D. filix-mas*, *Goldiana*, *Clintoniana*, *cristata*, *marginalis*, *floridana*, *arguta*, *fragrans* (incl. *D. aquilonaris* Maxon), *spinulosa*, and *patula* (*mexicana*).

2. GROUP OF *D. OPPOSITA*: *D. opposita*, *oregana* (*nevadensis*), *oreopteris*, *noveboracensis*, *simulata*, and *thelypteris*.

3. GROUP OF *D. PATENS*: *D. patens* (= *D. stipularis* Maxon), *normalis* (= *D. patens* Auctt.), *mollis* (= *D. parasitica*), (Louisiana, Alabama, Harper no. 130), and *D. gongylodes* (*unita*).

4. PHEGOPTERIS: *D. phegopteris*, *hexagonoptera*, *Linnaea* (*dryopteris*), and *Robertiana*. (*Phegopteris alpestris* is an *Athyrium*.)

5. CTENITIS: *D. ampla*.

6. GONIOPTERIS: *D. reptans*, *tetragona*.

7. MENISCIMUM: *D. reticulata*.

At least two other subgenera, *Glaphyopteris* (*D. decussata* and some few other species) and *Steiropteris* (*D. deltoidea* and five or six others) are represented in tropical America and the recently by me proposed new genus *Stigmatopteris* belongs to the Dryopterideæ. The Old World's species belong partly to the same subgenera, partly to others not represented in America. *Stigmatopteris*, *Goniopteris*, and *Glaphyopteris* are exclusively American.

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Notes on Southern California ferns

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During the past year, which I have spent in Southern California, I have had opportunities for collecting and studying the western ferns in their native haunts, and I have enjoyed tramping over the mountains and exploring the canyons in search of these interesting plants.

At Pasadena, where I have spent most of my time, the foothills rise directly back of the city, and back of these hills lie the San Gabriel Mountains, a bold range of mountains having an elevation of five thousand feet, with several peaks, such as Mt. Lowe and Mt. Wilson, rising a thousand feet higher. These mountain sides are very steep and are difficult to climb, except by following the trails. On every side the mountains are furrowed by deep canyons, through each of which flows a small mountain stream that descends the canyon in a series of pretty waterfalls and cascades. These canyons are beautiful spots and are a paradise for the botanist, especially in the winter, when everything is fresh and green.

The cool, shady sides of the canyons are the favorite haunts of some of our finest ferns. Here among the damp mosses will be found the California polypody, *Polypodium californicum* Kaulf., which forms a thick